

Application Serial No. 10/551,000
Reply to Office Action of December 28, 2006

PATENT
Docket: CU-4426

low temperature and into an stretched state at high temperature.

The references, however, merely disclose that a shape memory alloy is used as a forming material of the coil expander. The references are completely silent in disclosing the very characteristics of the present invention that the coil expander is "formed of anomaly wire having rectangular cross sectional shape." In the cited references, shape memory alloys are used as forming materials for coil expanders in order to improve the engine starting performance. As disclosed in lines 11 to 19, page 3 of the present application specification, the coil expander formed of shape memory alloys have a problem in obtaining a desired tension when shape memory alloys are used for a coil expander of the size that is used together with widely-used oil rings with reduced width. This is because the coil expander is formed of shape memory alloy wires, and has a modulus of transverse elasticity of about 1/4 of that of a coil expander formed of a steel wire. Although tension of the coil expander can be improved by an arrangement such as enlarging the diameter of the wire used for coil expander formation, large wires lead to the enlargement of diameter or pitch of the coil expander. Accordingly, a strict limitation in size is imposed and it is difficult to put the coil expander formed of a shape memory alloy into practice as a coil expander used with an oil ring with a reduced width.

Under such circumstances, by making a cross sectional shape of the wire used for a coil expander rectangular, the invention recited in Claim 8 of the present application enables the coil expander to obtain a desired tension without enlarging the outer diameter or pitch even when a shape memory alloy wire is used for forming the coil expander. The advantageous effects of the present invention is achieved by making a cross sectional shape of the wire rectangular, but not a conventional circular shape.

The rejection further asserts that "using a rectangular wire is considered obvious over (Dalley 149 USPQ 47 (CCPA 1966))." This precedent, however, concerns a disposable plastic baby bottle, which belongs to a completely different technical field from the present invention. Such well-known art that has a totally different application and function cannot possibly be an appropriate citation to reject an inventiveness of the present invention. As mentioned, the present invention achieves its unique effect of improving the tension by using a rectangular cross-sectional shape wire, without enlarging the outer diameter or pitch of the coil

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expander. The baby bottle, on the other hand, is not a kind of product that requires "tension" and it cannot achieve the same effect as the present invention even if the cross-section shape thereof is made rectangular.

The inventor of the present application conducted an additional experiment to prove that a larger variation of variable tension margin can be obtained when a rectangular cross-sectional shape wire is used compared to the case of using a circular cross sectional shape wire, in the case that the thickness of wire = width = diameter of the circle (all the same size). The experimental record and a declaration under 37 CFR 1.132 are attached to this comment.

The Example disclosed in the present application proved that a larger variation of variable tension margin was obtained when the width ratio was made larger to the thickness of a wire having a rectangular cross sectional shape. In addition to the result, the new experiment (Table 1) proves that a larger variation of variable tension margin than that of a circular cross-sectional shape wire can be obtained, irrespective of the ratio (even when the wire thickness : width = 1:1, by only making the cross-sectional shape of the wire rectangular).

Making the wire cross-sectional shape rectangular allows a coil expander formed of a shape memory alloy to achieve a greater spring effect. This effect is an unexpected result which is not disclosed by the prior art references. It would not have been obvious to a person of skill in the art that changing the shape of the shape memory alloy from circular to rectangular would produce this beneficial effect.

The cited references disclose the coil expander using a shape memory alloy, treated such that it is brought into a contraction state at low temperature and into a stretched state at high temperature, in order to improve engine starting performance. The present invention, on the other hand, improves and enables a coil expander formed of a shape memory alloy, which could not be used with oil rings with a reduced width, to drastically improve its tension without enlarging its size. The cited references are completely silent in disclosing the vital requirement to achieve such advantageous effect that the coil expander "is formed of anomaly wire having rectangular cross-sectional shape.", as claimed. Therefore, the Applicants consider that the obviousness rejections have been overcome and should be withdrawn.

With regard to Claim 12, although the cited references disclose the use of a coil expander formed of a shape memory alloy, they do not teach using the coil

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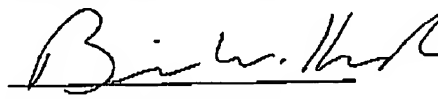
expander formed of the shape memory alloy for oil rings with a thinned width. By setting the width of the oil ring in an axial direction into a predetermined range, in addition to the common effect of improving the engine starting performance, the invention of claim 12 achieves the special effect of improving the following capacity of the oil ring, which cannot be achieved by the teachings of the prior art references.

In light of the foregoing response, all the outstanding objections and rejections are considered overcome. Applicant respectfully submits that this application should now be in condition for allowance and respectfully requests favorable consideration.

Respectfully submitted,

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